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## A METRICAL TRAGEDY

BY DR. JOS. V. COLLINS

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THE war in Europe has opened up a large field of trade in South America. Three things especially stand in the way of its development, viz., the absence of a proper credit system, the failure to make goods of the kind demanded and third, the use of our antiquated system of weights and measures, all the South American countries employing the metric system. Of these three obstructing influences, the first two are in a fair way to be obviated soon; not so the last.

It is the use by our modern progressive country of an ancient system of weights and measures which it is here proposed to discuss and show up as an absurdity. Our present system is organized and set forth in arithmetics under some fifteen so-called "tables." These tables are all different and there is no uniformity in any one table. Only one unit suggests convenience in reductions, viz., hundredweight. It is easy to reduce from pounds to hundredweight and *vice versa*. Some fifty ratio numbers have to be memorized or calculated from other memorized numbers to make the common needed reductions. History shows that ancient Babylonia had tables superior to those now in use, and ancient Britain a decimal scale which was crowded out by our present system.

The metric system of weights and measures was developed in France about 1800 and has come to be employed over all the civilized world except in the United States, Great Britain and Russia. The system was legalized in the United States in 1866 but not made mandatory and here we are fifty years later using the old system, with most of the civilized world looking on us with more or less scorn because of our belatedness.

In this age everywhere the cry is efficiency, always more efficiency. Ten thousand improvements and labor-saving devices are introduced every day. But here is an improvement and labor-saving device which would affect the life of every person in the land and in many instances greatly affect such persons' lives, and yet almost no one really knows anything about the matter.

So let us now consider the good points in the metric system (each implying corresponding elements of great weakness in the common system), and then study briefly what stands in the way of its adoption in this country. These good points are:

First, the metric units have uniform self-defining names (cent, mill,

meter and five more out of the eleven terms used already familiar to us in English words), are always the same in all lands, known everywhere, and fixed with scientific accuracy.

Second, every *reduction* is made almost instantaneously by merely moving the decimal point. There are no reductions performed by multiplying by 1,728 or 5,280, etc., or dividing by  $5\frac{1}{2}$ ,  $30\frac{1}{4}$  or  $31\frac{1}{2}$ , etc., and hence there is a *great saving* in the labor and time of making necessary calculations.

Third, there are but *five* tables in the metric system proper, these taking the place of from twelve to fifteen in our system (or lack of it). These are linear, square, cubic, capacity and weight.

Fourth, any one table is about as easy to learn as our United States money table, and after one is learned, it is much easier to learn the others, since the same prefixes with the same meanings are used in all.

Fifth, the weights of all objects are either known directly from their size, or can be very quickly found from their specific gravities.

Sixth, the subject is made so much easier for children in school that a conservative expert estimate of the saving is two thirds of a year in a child's school life. The rule in this country is eight years of arithmetic, the arithmetic occupying about one fourth of the child's activity. With metric arithmetic substituted for ours, what it now takes two years to prepare for, could be easily done in  $1\frac{1}{3}$  years. This involves an enormous waste of money and energy every twelvemonth.

Seventh, only *one* set of measures and *one* set of weights are needed to measure and weigh everything, and *one* set of machines to make things for the world's use. There would be no duplication of costly machinery to enter the foreign trade field, thus securing enormous saving. It is well known that the United States and Great Britain have lost a vast amount of foreign commerce in competition with Germany and France, because of their non-use of the metric units. Britain realizes this and is greatly concerned over the situation.

Eighth, every ordinary practical problem can be solved conveniently on an adding machine. Our adding machines are used almost solely for United States money problems.

Ninth, no valuable time is lost in making reductions from common to metric units, or *vice versa*, either by ourselves or foreigners. To make our sizes in manufactured goods concrete to them foreign customers have to reduce our measures to theirs and this is a weariness to the flesh.

Tenth, the metric system is wonderfully simple. All the tables with a rule to make all possible reductions can be put on a postal card.<sup>1</sup>

The metric weights and measures constitute a *scientific system*; our weights and measures are a *disorganization*. Naturally one can expect a *great saving of time, thought and labor* from the use of a system, and

<sup>1</sup> See article by the writer in *Education* (Boston), Dec., 1894.

this is the fact. If one dared introduce ordinary arithmetical problems into an article like this, it would be easy to show by examples how a person has to be something of a master of common fractions in order to solve in our system common every-day problems, whereas in the metric system nearly everything is done very simply with decimals. In our system a mechanic after making a complicated calculation with common fractions is as likely as not to get his result in sixths, or ninths, etc., of an inch, whereas his rule reads to eighths, or sixteenths, and he must reduce his sixths, or ninths, to eighths, or sixteenths, before he can measure off his result. In the metric system results always come out in units of the scale used. The metric system measures to millimeters or to a unit a trifle larger than a thirty-second of an inch. In our system one is likely to avoid sixteenths or thirty-seconds on account of the labor of calculation. Then, besides, the amount of figuring is so much less in the metric system. Take the case of a certain problem to find the cubical contents of a box. Our solution calls for 80 figures and the metric for 35, and this is a typical case, not one specially selected. Thus, metric calculations, while only from one third to two thirds as long, are likely to be two or three times as accurate, are far easier to understand, and the results can be immediately measured off. Hence, we waste time in these four ways. Shakespeare in Hamlet says: "Thus conscience does make cowards of us all." In like vein it might be said: Thus custom (in weights and measures) doth make April fools of us all. It is no exaggeration to say that counting grown-ups solving actual problems and children solving problems in school we are sent on much more than a billion such April fool errands round Robin Hood's barn every year.

Noting how much time is saved in making simple every-day calculations by using the metric system, suppose that we assume of the 60 or more millions of adults in active life in this country, on the average only one in 60 makes such calculations daily and that only twenty minutes' time is saved each day. Let us suppose that the value of the time of the users is put at \$2.40 per day or 10 cents for 20 minutes. Then 1,000,000 users would save \$100,000 per day or \$30,000,000 per year. But perhaps some one is saying that much of this time is not really saved, since many persons are paid for their time and can just as well do this work as not. The answer to this is that in many instances such calculations take the time of *others* as well as the person making the calculation. Occasionally a contractor might hold back, or work to a disadvantage a gang of a score of workmen while trying to solve a problem that came up unexpectedly.

An estimate of the value of all weighing and measuring instruments places the sum at \$150,000,000. Thus, we see that in five years, merely by a saving in *time*—for time is money—all metric measuring and

weighing instruments could be got *new* at no extra expense. This estimate of the cost of replacing our weighing and measuring instruments by new metric ones and of saving time has been made by others with a similar result.

A matter of very much more importance than that just discussed is the extra unnecessary expense put upon education, viz., two thirds of a year for every child in the land. Presumably if the metric system were in use with us, all our children would stay in school as long as they now do, thus getting two thirds of a year farther along in the course of study. Actually, if arithmetic were made more simple, vast numbers would stay longer, since they would not be driven out of school by the terrible inroads on their interest in school work by dull and to them impossible arithmetic. If metric arithmetic texts were substituted for our present texts, it is safe to say children would average one full year more of education. What the increased earning power would be from this it would be hard to estimate, but clearly it would be a huge sum.

Consider also how much more life would be worth living for children, teachers and parents if a very large portion of arithmetical puzzles inserted to qualify the children to understand our crazy weights and measures were cut out of our text-books. If we were to adopt the metric system, literally millions of parents would be spared worry, and shame, and fear lest Johnny fail and drop out of school, or Mary show unexpected weakness and have to take a grade over again; uncounted thousands of teachers would be saved much gnashing of teeth and uttering of mild feminine imprecations under their breath; and, best of all, the children themselves would be saved from pencil-biting, tears, worries, heartburns, arrested development, shame and loss of education!

A committee of the National Educational Association has recently reported that Germany and France are each two full years ahead of us in educational achievement, that is, children in those countries of a certain age have as good an education as our children which are two years the foreign childrens' seniors. Surely one of these years is fully accounted for by the inferiority of our American *arithmetic* and *spelling*. This much, at least, of the difference is neither in the children themselves, nor in the lack of preparation of our teachers, nor in educational methods.

Professor J. W. A. Young, of the University of Chicago, in his work on "Mathematics in Prussia," says: "In the work in mathematics done in the nine years from the age of nine on, we Americans accomplish no more than the Prussians, while we give to the work seven fourths of the time the Germans give." Professor James Pierpont, of Yale, writing in the *Bulletin* of the American Mathematical Society (April, 1900), shows a like comparison can be made with French instruction. Pierpont's table exhibits only one hour a week needed for arithmetic for pupils

aged 11 and 12! As the advertisements sometimes say, there must be a reason.

But if the children are kept in school two thirds of a year longer somebody pays for this extra expense. Now children do not drop out of school until they are about 12 years of age and have both appetites and earning power. The number of these children that drop out each year is probably about  $2\frac{1}{2}$  millions. Of this number let us say  $1\frac{1}{2}$  millions would become wage earners, thus passing from the class that are supported to the class that support themselves and earn a small wage besides. We have then three items in this count: (1) The cost to the state in taxes for the education of  $2\frac{1}{2}$  million for two thirds of a year, or \$50,000,000; (2) The cost to the parents for support of  $1\frac{1}{2}$  millions for two thirds of a year at \$67 each, or \$100,000,000; (3) The wages of  $1\frac{1}{2}$  millions over and above the cost of their support, say \$50 each, or \$75,000,000.

The above figures are put low purposely so that they can not be criticized. It should be remembered that 46 per cent. of our population is agricultural, and that on the farm, youths of from 13 to 15 very often do men's and women's work: also that in many manufacturing centers great numbers of children get work at relatively good wages, and that the number of completely idle children out of school is not large.

With these figures in hand let us consider now a kind of debit and credit sheet against and for our present system of weights and measures.

#### PRESENT SYSTEM OF WEIGHTS AND MEASURES

##### In *annual* account with UNCLE SAM

Dr.		Cr.
To cost in school taxes of keeping $2\frac{1}{2}$ millions of children in school $\frac{2}{3}$ year.	\$50,000,000	By culture (?) acquired by the children through learning more common fractions and our crazy tables of weights and measures .....\$?
To cost to parents for supporting $1\frac{1}{2}$ millions children $\frac{2}{3}$ year .....	100,000,000	
To loss of productive power of $1\frac{1}{2}$ millions youth for $\frac{2}{3}$ year .....	75,000,000	
To loss of earning power by having children driven out of school by difficulties of arithmetic as now taught .....	25,000,000	
To loss of time in making arithmetical calculations by men in trade, industries and manufactures .....	30,000,000	
To extra weighing and measuring instruments needed for sundry tables.	10,000,000	
To loss of time in making cross reductions to and from our system and metric system .....	5,000,000	
To loss of profit from foreign trade because our goods are not in metric units .....	20,000,000	
Total annual loss .....	\$315,000,000	

Commenting for a moment on the credit side of the above ledger account, it can be said that recent psychology shows conclusively that training in common fractions and weights and measures can not be of much practical help as so-called culture, or training for learning other things, unless those other things are closely related to them, and there are not many things in life so related to them once we had dropped our present weights and measures.

It may be complained that the expense of changing to the new system is not taken account of in the above table. The reason is that that expense would occur once for all. The above table deals with the *annual* cost of our present medieval system.

One powerful reason for the adoption of the metric system different in character from the others is the ease of cheating by the old system. In the past the people have been unmercifully abused through short weights and measures. Many of the states have taken this matter up latterly and prosecuted merchants right and left. Nine tenths of this trouble would disappear with the new system in use.

Let us consider now for a little time the reasons why the metric system has not been accepted and adopted for use in the United States. Evidently the great main reason has been that the masses of the people, in fact all of them except a very small educated class in science are almost totally uninformed on this whole question. Such articles as have been published have almost invariably appeared in either scientific, technical or educational magazines, mostly the first, so that there has been no means of reaching the masses, or even the school teachers with the facts. For another reason the United States occupies an isolated position geographically, and our people do not come into personal contact with those in other countries using the metric system. But there is still another potent reason. After the United States government legalized the metric system in 1866, all the school books on arithmetic began presenting the topic of the metric system, and, quite naturally, they did it by comparing its units with those of our system and calling for cross reductions from one system to the other. No better means of sickening the American children with the metric system could have been devised. Multitudes of the young formed a strong dislike for the foreign system with its foreign names, and could not now be easily convinced that it is not difficult to learn. Every school boy knows how easy it is to learn United States money. The boy just naturally learns it between two nights. The whole metric system *under favorable conditions* is learned nearly as easily. By favorable conditions is meant the constant use of the system in homes, schools, stores, etc. These favorable conditions, of course, we have never had.

In 1904 an earnest effort was made again both in this country and

Great Britain to have the metric system adopted for general use. The exporting manufacturers in both countries grew much concerned over the whole situation. A petition to have the metric system adopted in Great Britain was signed by over 2,000,000 persons. A bill to make the system mandatory was passed by the House of Lords and its first reading in the House of Commons. The forces of conservatism then bestirred themselves and the bill was held up. Forseeing a movement of the same kind in this country, the American Manufactures' Association got busy, laid plans to defeat such movement which they later did. Strictly speaking this action was not taken by the association as such but only by a part of it. One fourth of the membership and probably much more than a fourth of the capital of the association was on the side for the adoption of the system. Politically, however, the side opposed to the new system had altogether the most influence.

Careful study of the whole matter showed that the main cost to make the change to the new system would be in dies, patterns, gauges, jigs, etc. A careful estimate put this cost at \$600 for each workman and assuming a million workmen, we have a total cost of \$600,000,000. But we have just seen that the annual expense of retaining the old system of weights and measures is over \$300,000,000. Thus we see that two short years would suffice to pay for what seems to the great manufacturers association an insuperable expense. From all this we see that the question is not one for N. M. A. bookkeeping, but for national bookkeeping.

Many well-informed people studying the matter superficially, think the difficulties in the way of a change to the new system insurmountable. Thus, they think of the cost to the manufacturer—which we have just seen to be rather large but not insurmountable; they think of the changes needed in books, records, such as deeds, and the substitution of new measuring and weighing instruments. Germany and all the other countries of continental Europe made the change. Are we to assume that the United States can not? That would be ridiculous. Granting that commerce has grown greatly; so also has intelligence and capability of the people for doing great things.

Scientists are universally agreed as to the wisdom of the adoption of the metric system. The country, as a whole, must be educated up to the notion that sooner or later it is sure to be universally adopted, that it is only a question of time when this will be done. Already electrical, chemical and optical manufacturing concerns use the metric units and system exclusively. The system is also used widely in medicine and still other arts. Then all institutions of learning use the metric system exclusively whenever this is possible. All that is needed is to complete a good work well begun.

There is one rational objection to the metric system and but one.

It is that 10 is inferior to 12 as a base for a notation for numbers, but the world is not ready to make this change nor is it likely to be for generations to come. Moreover, this improvement is far less important than uniformity in weights and measures. For these reasons this objection can be passed over. Men said the metric system would never be used outside of France; but it has come to be used all over the world. The prophets said we should never have uniformity as regards a reference meridian of longitude. But we have. And so it will be with the adoption of the metric system in the United States and Great Britain. It is only a question of whether it comes sooner or later. When that day comes, the meter, a long yard, will replace the yard, the liter, the quart (being smaller than a dry and larger than a liquid quart), the kilogram will replace the pound, being equal to 2.2 pounds, and the kilometer (.6 mi.) will replace the mile. Within a week or so after the change has been made to the new system, all men in business will be reasonably familiar with the new units and how they are used, and within a few months every man, woman and child will be as familiar with the new system as they ever were with the simplest parts of the old. So easy it will be to make the change as far as ordinary business affairs are concerned. However, for exact metal manufactures years will be needed to fully change over to the new. Here the plan is to begin with new unit constructions and new models, as automobiles using new machinery constructed in the integral units of the metric system. All old constructions are left as they are and repaired as they are. This was the plan used in Germany and of course it works.

In conclusion it can be said that we started with the idea that the change to the metric system was needed for the sake of foreign commerce. We now see that we need it also for our own commercial and manufacturing transactions. If we are to have the efficiency so insistently demanded by the age in which we live, then we must have the metric system in use for the ordinary affairs of daily life of the masses of the people, we must have it in commercial and manufacturing industries, and we must have it in education. If efficiency is to be the slogan, then the metric system must come no matter what obstacles stand in its way.